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ABSTRACT

Drawn from a symposium presented at the 1979 National Reading Conference, the four papers in this collection describe a notion of conceptual readability, an approach contrasting with traditional readability computations (number of words per sentence and degree of familiarity of individual words) and focusing on the concepts communicated by the text (how arguments are presented, what place examples play in an exposition, how characters' interactions are developed and described). The first paper demonstrates how certain uses of traditional readability formulas may actually lead to more difficult texts. The second paper presents a model with which to examine conflict in stories and discusses the application of this model to children's literature to expand students' understanding of what they read. The third paper describes a method of mapping the structure of expository texts and discusses its possible uses as a measure of text comprehensibility. The final paper suggests an educational method that encourages children to focus on the conceptual level of text in their early reading and writing experiences. (RL)

CENTER FOR THE STUDY OF READING

Reading Education Report No. 31

CONCEPTUAL READABILITY: NEW WAYS TO LOOK AT TEXT

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Abstract

The papers in this collection describe a notion of "conceptual readability" which contrasts our approach to text with that assumed by standard readability formulas. Traditionally, the readability level of a text has been calculated by considering text characteristics such as the number of words per sentence and the degree of familiarity of individual words. Our approach focuses instead on the concepts communicated by the text: how arguments are presented, what place examples play in an exposition, how characters' interactions are developed and described.

In this report, we first demonstrate how certain uses of traditional readability formulas may actually lead to more difficult texts. Next, we discuss two alternative text analysis methods which are sensitive to structural, semantic and discourse characteristics. Finally, we suggest an educational method which encourages children to focus on the conceptual level of text in their early reading and writing experiences.

Introduction

Andee Rubin

This report is based on a symposium presented jointly by Bolt Beranek and Newman and the University of Illinois at the 1979 National Reading Conference in San Antonio. After the presentation, the authors decided to publish all four papers and the discussion as a single report since they were united by a common theme and illustrated different consequences of a single perspective. The reports follow here in the order in which they were delivered at the conference.

The title of this symposium was Conceptual Readability: Applications of Text Structure Analysis. "Conceptual readability" is a term we have coined which contrasts the approach we take to text with that assumed by standard readability formulas. Traditionally, the readability level of a text has been calculated by considering text characteristics such as the number of words per sentence, the degree of familiarity of individual words, or the number of syllables per sentence (Klare, 1974-75) as a shorthand, we have called these "low-level" text characteristics. As implied by its name, our approach focuses on the concepts communicated by the text--how arguments are presented, what place examples play in an exposition, what inferences must be made by the reader, how characters'

interactions are developed, in short on "high-level" text characteristics. (This recognition of "higher-level" structures is far from new; other investigators such as Meyer, 1975, Frederiksen, 1975, Bruce, 1980a, and Rumelhart, 1975, have similarly concentrated on these aspects of text, although not in the context of readability.) Our contrasting approach has led us to question some traditional used of readability formulas, to develop new methods of analyzing texts, and to design new educational devices.

Our first paper will demonstrate how focusing on low-level text characteristics in the process of simplifying texts for children can lead paradoxically to more difficult texts and how consideration of other text structures could result in more successful adaptations. The next paper will present a model with which to examine conflict in stories, discuss its application to children's literature, and consider its implication for expanding students' understanding of what they read. The third paper will describe a method of mapping the structure of expository texts and discuss its possible use as a measure of text comprehensibility. Finally, the last paper will explore one application of our approach in the classroom--an educational device which encourages children to focus on the conceptual level of text even in their early reading and writing experiences.

Categories and Strategies of Adaptation in Children's Reading Materials

Robert N. Kantor and Alice Davison

For the last 30 or 40 years much attention has been paid to formulas that claim to measure readability. The widespread use of such formulas is bound to have an effect on the texts that are produced for children learning to read. In this section we consider the implications of using readability formulas not just for measuring readability, but also as a guide to producing texts, in this case adapted ones.

The creators of the formulas and others have always warned against using the formulas as guides to production, because the correlation of infrequent vocabulary and long sentences to difficulty in reading does not necessarily imply a causal relationship. Furthermore, it is impossible to use these formulas literally as guides to writing, because provided that one wants to preserve content, the injunction to simplify vocabulary, perhaps by paraphrase, conflicts with the injunction to shorten sentences.

However, because of pressures to produce materials at a specific readability level, writers are often tempted to constrain their writing according to the factors involved in readability formulas. This may affect textbooks for children

(and for college students), legal and other documents that must be written in "plain English," and captioning for hearing-impaired people. In our own work, we have examined texts adapted for use by younger readers, and here too have found what we believe to be pervasive effects of readability formulas.

We looked at four texts from SRA Reading Laboratory 111b (Parker, 1963) designed for students in eighth, ninth, or tenth grade who are reading at levels 5 to 6. We secured the original sources (Glueck, 1962; Mattox, 1961; Melbo, 1941; Parsons, 1913; hereafter referred to as MILK, LIGHT, TREES, and DAYTON, respectively) and did a sentence-by-sentence analysis to determine what information was common to the two versions and what had been changed. All the texts were shortened, average sentence length was lowered, average number of clauses per sentence was reduced, and scores on the Fry and Dale-Chall scales were lowered by 0 to 5 grade levels. We prepared an exhaustive listing of all the changes made in the adaptations, from which we derived a taxonomy of change types in adaptation. The taxonomy is presented in Davison, Kantor, Hannah, Hermon, Lutz, and Salzillo (1980).

Examination of adapted texts shows that adaptors do not follow readability formulas slavishly. We noted a good deal of conscientious and careful rewriting, but as the examples we will

discuss presently show, it seems that vocabulary lists and restrictions on sentence length and passage length are often given primary importance at the expense of factors related to conceptual readability. We will argue in this section that more attention needs to be given to these factors for which there is to date no objective measurement.

What are these larger considerations that a writer (or adaptor) must be concerned with? The writer should worry first of all about the overall presentation of ideas, i.e., the order in which ideas are to be presented and their logical interrelationships. He or she must also be concerned with more local organization, i.e., what the topic of discourse is at various points in the text, and where transitions between ideas need to be made. Since the intended reader may not possess requisite background knowledge to understand a fact or concept, the writer must sometimes fill in this information for the reader. Finally, the writer must consider matters which influence or shape the reader's evaluation of information, e.g., whose attitude is being expressed or whether a statement asserts a fact or is just a supposition.

Our purpose in the following discussion is to show what happens to these global considerations when an adaptor operating under a number of different constraints is forced to decide what

to change and how to change it. Generally the passage has to be shortened--in our sample anywhere from 32 to 83%--and the end-product must be objectively rated according to at least two readability formulas.

Overall Organization

Since the text an adaptor receives has been chosen for inclusion in a series of reading materials, the adaptor might well assume that the organization of the original is satisfactory, and therefore choose to leave this organization as it is. We did no formal study of overall organization or text structure of our texts and adaptations because we did not find any model that we felt could satisfactorily describe text structure. However, it was extremely interesting to us that the text which was most radically restructured from the original was the text which we and a number of others considered to be the most coherent and successful adaptation. That passage was MILK, which originally appeared as a New York Times feature article and whose original organization was that typically appearing in journalistic prose.

Local Organization

In order to discuss several different aspects of local organization in adaptation, we have chosen a passage from LIGHT,

shown in (1) and (2). (1) is the original and (2) is the adapted passage.

1. LIGHT (original)

(x) In several parts of the world, there are heavy concentrations of these lumirous one-celled animals.

(y) Motor launches take visitors into such a lagoon (a) on the southern coast of Puerto Rico where (b) on dark nights there is a dramatic display of luminescence. (c) Curving lines of light fall from the bow (d) as the launch enters the lagoon, and (e) a trail of light is left in the boat's wake. In the lagoon, (f) which has one of the greatest concentrations of bioluminescence in the world, (g) it appears as though a huge floodlight were burning under the launch, and (h) the bow seems to be plowing into a wall of fire.

Sentence structure:

'[('y/a) (b)] [(c) (d) (e)] [(f) (g) (h)]

2. (adaptation)

(a) On the southern coast of Puerto Rico is a lagoon (f) that has one of the greatest amounts of

bioluminescence in the world, (b) On dark nights, it creates a very dramatic display. (d/y) As the motor launch takes visitors into the lagoon, (c) curving lines of light fall from the bow. (e) A trail of light is left in the boat's wake. (g) It appears as though a huge floodlight were burning under the launch, and (h) the bow seems to be plowing into a wall of fire.

Sentence structure:

[(a) (f)] [(b)] [(d/y) (c)] [(e)] [(g) (h)]

This pair of passages illustrates three interdependent phenomena related to local organization that may be affected in the process of adaptation: referential connection, propositional connection, and paragraph organization.

With regard to referential connection, the adaptor has improved on the original in one instance (such a lagoon [1y] has no prior discourse referent; the adaptor introduces lagoon via an existential construction [2a]), but has allowed the definite description the motor launch to appear in [2d/y] without the prior discourse referent that did occur in [1y]. Perhaps this occurred because the adaptor's attention was focused not on the details of referential connection but on the mechanics of

restructuring and shortening sentences, as a readability formula would encourage him or her to do.

Note that there are three sentences in the original (disregarding [lx]) which are restructured into five sentences in the adaptation. The original sentences are more complex, two having three clauses and one having two clauses. Of the adaptation sentences, two consist of one clause and three of two clauses. One effect of splitting up sentences here is that the adaptor is forced to move clause (f) to the beginning of the paragraph, since simply splitting it off would involve loss of propositional connection and lead to incoherence.

Splitting of sentences in adaptation may thus lead to changes in paragraph organization. In this example, the restructuring has the effect of placing all background information in paragraph-initial position, perhaps a more logical ordering, but one that may also involve a loss of stylistic interest.

While in the above example the adaptor seems to have been able to compensate somewhat through ordering for loss of propositional connection, in (3) the splitting forces the reader to guess at the relationship between the propositions.

3. TREES

(a) If given a chance before another fire comes, the tree will heal its own wounds by growing new bark over the burned part. (original)

(b) If given a chance before another fire comes, the tree will heal its won wounds. It will grow new bark over the burned part. (adaptation)

If the reader does not have knowledge about the physiology/biology of trees, or makes an incorrect guess, healing wounds and growing new bark could be seen as two separate processes. This illustrates what may happen if complex sentences are mechanically split up, particularly when connectives which indicate logical relations, i.e., cause, means, sequence, result, are lost in the process.

Background Information

In passages (4) and (5), we find both the deletion and the addition of background information. In (5a) the information that the milk used to flood the rink was surplus has been deleted.

4. MILK (original)

(a) In Toronto, a suburban ice-skating rink was flooded with 250 surplus gallons of it [= skim milk].

(b) Skaters found it chipped less easily than frozen water.

5. (adaptation)

(a) An ice-skating rink was flooded with it [= skim milk].

(b) Skaters found that when it froze it chipped less easily than frozen water.

The adaptor here has deleted the explanation for this otherwise wasteful use of milk. We suspect that the adaptor's motivation was that surplus is a difficult or infrequent word. A paraphrase such as "milk that might have spoiled" could have been used, but such a paraphrase would have increased the sentence length and added a subordinate clause.

Comparing (4b) with (5b), we see that the adaptor has added information by inserting a subordinate clause, when it froze. This spells out the inference that an adult and likely a child would have no trouble making, i.e., that the milk had to freeze before people skated on it. Obviously the choice of what is deleted and what is added is a matter of intuition on the part of the adaptor, but we are quite surprised that surplus was not included while the fact that the skim milk would freeze was not left to be inferred.

Evaluation of Information

Our final example, comparing original (6a) with adaptation (6b), illustrates what happens to information that a reader might use to evaluate the status of a proposition as a fact or supposition.

6. TREES

(a) A railroad freight agent has figured that it would require at least 40 modern flat cars to haul just the trunk along. (original)

(b) And at least forty freight cars would be needed to haul away just its trunk. (adaptation)

By deleting the main clause, A railroad agent has figured that, the adaptor presents the remaining sentence as an absolute fact. The reader has no basis for evaluation of the statement, except to believe the author unquestioningly. In this case, citing the railway freight agent would lend authority to the proposition, but in other cases, the source of a statement might well have been unreliable. In real life people have to evaluate statements according to their sources, and yet children get little practice in this if source clauses are generally deleted in the material they encounter. We noted many such deletions in our sample. We suspect this information was deleted simply to facilitate the shortenting of the sentences.

To conclude, we would like to offer some suggestions to people who produce reading texts and also to people who buy the texts. Pay less attention to readability formulas and more to content and organization. Several studies (Glazer, 1974; Kaiser, Neils, & Floriani, 1975) have already shown that sentence length per se does not necessarily contribute to complexity and hence to difficulty in reading. Psycholinguists and linguists (including ourselves) have argued that sentence complexity is relative to many factors, including the discourse context. It is not an absolute value. Those who produce and those who demand texts at guaranteed fixed readability levels may be directing attention to unproductive manipulations of language and away from language which would give children opportunities to develop their conceptual skills.

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Conflict: An Analysis of a Higher-Level Story Feature and Its Application to Children's Literature

Cindy Steinberg and Bertram Bruce

Traditional studies of children's literature have examined features such as text structure and topic (Zimet, 1972; Zimet & Camp, 1974; Sebesta, Note 1), but have failed to take into account aspects of character interaction such as the types of conflict engaged in by story characters and the response of characters to conflict. Similarly, they have glossed over rhetorical elements such as author-reader distance, commentary, point of view, and insight into characters' minds. These "higher-level features" of stories may be what makes stories interesting to read. They are also principal contributors to story complexity, and hence, to difficulty for beginning readers. With regard to both interestingness and complexity, it is important to come to a better understanding of these features.

We have been conducting studies aimed at understanding the role that these higher-level structures play in various forms of reading material that children encounter in school and free reading. As part of our study, we have developed a framework in which to place these features, which we have called the social interaction model of reading. Briefly, a text is viewed as a form of communication, and communication implies social

interaction. The social interaction that occurs within a text can be viewed as operating on various levels. The three basic levels of social interaction that occur in any written text are depicted in Figure 1.

At Level 0 we have the always present communication that occurs between the real author and the real reader via the written text. Level 1 represents an implied communication between the implied author and the implied reader. Although we speak of the "author of a story," we cannot know whether the author visible to us accurately represents the views of the person by that name. That is, the author we see is really an implied author (Booth, 1961). In fact, the implied author is like the real author only to the extent that the real author correctly portrays her or his own beliefs, language, and values. In a similar fashion, the real reader differs from the implied reader. At the implied author-implied reader level, we examine rhetorical forms, point of view, and inside view of characters. Level 2 represents character-to-character interactions. Features of text which we analyze at the character-to-character level include interacting plans, belief spaces, character goals and intentions, cooperation and conflict.

For the purpose of this section we focus on our work at the character-to-character level of text, in particular on conflict,

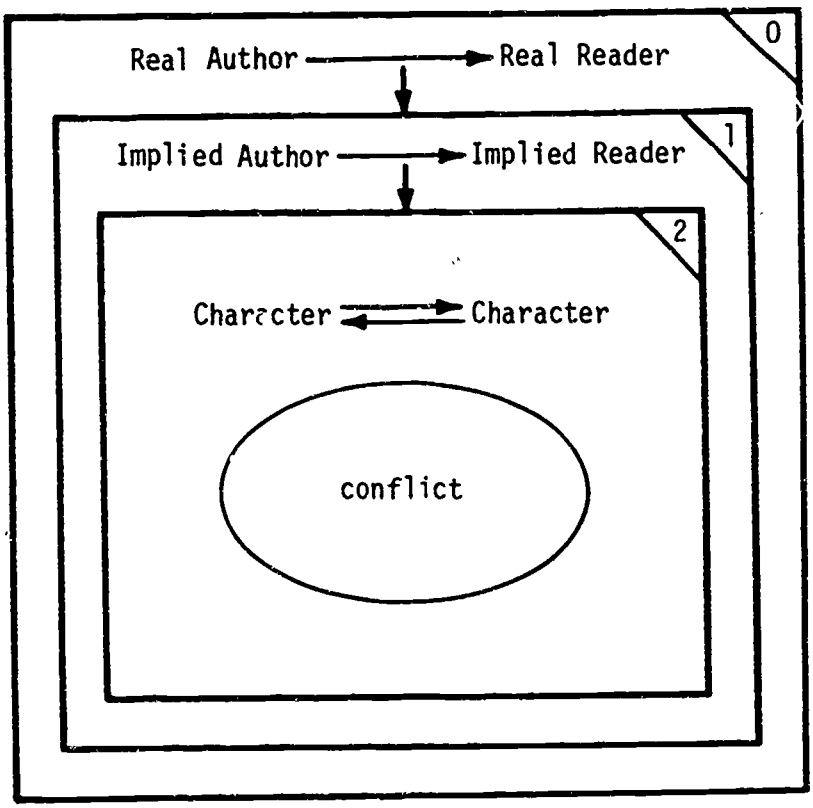

Figure 1. Levels of communication for a single story.

an important story feature occurring at this level. For a more complete discussion of the social interaction model of reading see Bruce (1980b). Also, for an analysis of the author-to-reader text levels mentioned above and the application of these levels to children's literature, we refer the reader to Steinberg and Bruce (1980).

To concretize our discussion of story conflict, consider the following modified fairy tale:

> Once upon a time, there lived a little girl who always wore a red cloak with a big red hood. One day her mother asked her to take a cake to her ailing grandmother. Being fond of her grandmother, she put on her cloak and joyfully started out on the errand. The little girl took a path through the woods gathering nuts and flowers along the way. By and by, she reached her grannie's cottage. When she knocked at the door, the old woman welcomed her in. They both sat down and had some cake together. After they were finished, the little girl said goodbye and went home.

Someone who heard this story might well say, "And what happened?" Clearly, something is missing from the story, even though the words, the sentence structures, the characters, and

the topic are similar to those in "Little Red Riding Hood." But who would remember Little Red Riding Hood today if she had never encountered the wolf? It seems that conflict is an essential ingredient in this story, and perhaps for stories in general. As the novelist John Le Carre (Barber, 1977) says, "The cat sat on the mat, is not a story. The cat sat on the dog's mat, is a story."

Why is conflict so important? There are a number of reasons. First, conflicts involve situations or events that are unusual, that are extraordinary, or that in some way alter the status quo. In a sense, they make a story newsworthy. Second, conflicts consist of unknown and uncertain factors which can generate a sense of mystery, curiosity, or suspense and can lead to surprise. We have the feeling that something is going to happen in a conflict, that things are not in a stable state. We wonder, for example, how will the conflict progress? Will it reach a resolution? Third, our interest in the resolution of a conflict relates to our concern for the characters we have come to care about in a story. Their conflicts are important for them, hence for us. Fourth, their conflicts and attempts at resolution can be associated with the conflicts in our experience. People read about conflict partly because conflicts are common in human interactions. Finally, conflicts can be rich, varied, intricate, and complex in the path they take from

their initial materialization to their subsequent resolution. Thus, we are intrigued by the possibilities inherent in the path towards resolution. Some of these intricacies are suggested by the definitions to follow.

Conflict Types

Conflict is a situation in which a character or characters are unable to achieve one or more of their desired goals. We define three types of conflict: interpersonal, internal, and environmental. An interpersonal conflict exists when two or more characters maintain incompatible goals. An internal conflict appears when a single character maintains two or more incompatible goals. An environmental conflict exists when a character's goal is hampered by nature, society, or fate. One could study an interpersonal or even an internal conflict from any of the opposing viewpoints.

Responses to Conflicts

In order to study the development of conflict in a story, we need to consider how characters respond to conflicts. A response mode is a verbalization, a thought, or an action that a character makes subsequent to and related to the conflict. This implies that the participant, at some level, was aware of his or her involvement in the conflict.

A response mode might or might not be a move predicated to achieve the desired goal. For example, devising a clever solution can be seen as an obvious attempt to attain a goal, whereas engaging in an argument about whether to embark on some course of action toward the goal would be counterproductive. One could also talk about response modes that are believable or reasonable in relationship to the goal, or responses that tend to escalate or de-escalate a conflict. More importantly, one could talk about response modes that are "constructive" in relation to the goal, i.e., responses that are more likely to bring about the achievement of the goal.

Conflict Resolution

An important element in the structure of story conflict which needs definition is resolution. A resolution is a working out of the conflict or an end to the original conflict. From an individual character perspective, it is the relationship between the character and the original goal. That relationship can exist in any of five states. The character could achieve the original goal; partially achieve the goal (essentially a compromise); forsake the goal, willingly and completely giving it up; forsake the original goal but formulate and adopt a new goal; or fail to a achieve the goal and accept the failure, thus abandoning the goal. Finally, in a sixth, unresolved state, the character could

fail to achieve the original goal but not abandon it. He or she would still be embroiled in the original conflict and might well attempt an alternate response mode.

Initial Story Survey

The formalizations of conflict which we have developed provide a useful framework in which to study children's stories. In order to apply notions made explicit by our analysis, we devised a coding form intended for use with primary-level children's texts. The form is composed of questions on conflict type, response and resolution modes. In addition, it includes a single metric of conflict complexity we have devised which takes into account such factors as: the number of conflicts per story, the number of different types of conflict, the number of participants involved in story conflicts, the intensity of each conflict, the length of time story conflicts remain in focus, the number of response modes utilized, etc.

We had two main purposes in conducting our initial story survey: (a) to determine the prevalence and distribution of the story features illuminated by our analysis in a sample of children's texts; and (b) to examine the relationship between traditional measures of story complexity, the most well-known of these being readability formulas, and our own conflict complexity

measure in the sample of texts chosen. We selected a sample of 32 children's texts composed of 16 upper-level primary and 16 lower-level primary stories distributed evenly among four groups: popular trade books, random trade books, widely read basal stories, and stories from other educational texts. We then computed the Fog (Klare, 1963) and Spache (1978) readability formulas on each of the stories in the sample. Five adult raters coded the stories using the form discussed above.

We found 100% agreement among raters that 29 out of the 32 stories exhibited conflict. All three of the stories for which evidence of conflict was unclear were lower-level primary texts. Although these numbers are small, this finding, if corroborated in a larger study, could raise questions about the traditional emphasis placed on vocabulary and sentence length in beginning readers. Perhaps we are unnecessarily forsaking important text features, such as conflict, which often lend structure, cohesiveness, excitement, and diversity to stories.

Of the three types of conflict discussed above, interpersonal conflict was found to be more frequent and more widespread in our sample. Twenty-eight out of 32 stories exhibited interpersonal conflict, 23 out of 32 stories had environmental conflict, and 8 out of the 32 exhibited internal conflict. Thus, internal conflict is a relatively infrequent

form in the children's stories sampled. When raters were asked to code conflict type for the two most important conflicts in each story, the results were as follows: 59.34% interpersonal conflict, 34.14% environmental conflict, and 6.50% internal conflict. We calculated the distribution of conflict types for the four groups in our sample. Interpersonal conflict was found to be most prevalent in all groups except the popular basal category, where environmental conflicts outnumbered the other two forms. This trend was even more pronounced for the lower-level stories. Lower-level random trade stories had the same number of environmental and interpersonal conflicts and no internal conflicts. Lower-level popular trade stories and other educational texts exhibited fewer environmental than interpersonal conflicts and still fewer internal conflicts. However, in the lower-level popular basal category, environmental conflicts outnumbered interpersonal conflicts by 6 to 1, and there were no internal conflicts. For children whose reading exposure is largely limited to school text, this somewhat unusual distribution of conflict types and over abundance of environmental conflicts in basal stories may lead to difficulty in understanding conflict forms encountered in reading other texts.

A second aim of our study was to determine if a relationship existed between the readability scores on our sample, which

purport to measure story complexity, and our own conflict complexity measure. Raters' conflict complexity metrics were transcribed from the coding forms and then averaged across raters for each story. Next, we calculated both the Pearson product-moment correlation coefficient and the Spearman rank correlation coefficient for the Fog readability measures versus the average conflict metrics for the 32 stories. Neither of these coefficients achieved conventional levels of statistical significance (Pearson r = 0.298; Spearman r = 0.161). The low correlation suggests that traditional readability measures may be missing important facets of what makes a story complex (see also Bruce & Newman, 1978; Bruce, Rubin, & Starr, 1980; Bruce & Rubin, Note 2).

Implications

Our model of story conflict is one step towards a richer language for discussing stories and for enhancing children's understanding of stories. Its most important contribution may lie in furthering the dialogue between teachers and students regarding the literature which they read. This new language also permits us to examine some other issues more effectively.

One issue is that of defining the readability of texts. The problems children encounter in comprehension may lie not just in the length of sentences or word difficulty, as traditional

readability formulas suggest, but in the complexity of the conflicts portrayed in the story. For example, responding to conflict using deception requires a character to view the world from another character's point of view (see the analysis of "Hansel and Gretel" in Bruce & Newman, 1978). Such a shift necessitates inferences that produce a greater overall complexity in the story than there would be if the conflict were confronted directly. Hence, younger children may have difficulty understanding certain stories because they include complex conflict sequences that previously went unnoticed (Bruce, 1980a).

Another issue is reader involvement. If conflict in real life situations has the power to arouse and engage human interest and generate excitement, mystery, curiosity, suspense, and surprise, it is important to study what types and features of conflict in stories could generate the same excitement for a reader.

Another result of these studies could be better criteria for text design and selection. Complaints leveled at some educational texts claim that the conflicts that do exist in stories are monotonous and uninspired (Blom, Waite, & Zimet, 1970). On the other hand, fairy tales are said to have survived precisely because they retain familiar conflict patterns in a simple form (Bettelheim, 1976). By applying our model, we hope

to be able to articulate criteria which will improve the quality of children's stories.

Children's difficulties in understanding texts might be due to mismatched expectations arising from cultural differences. Smitherman (1977) has argued that in black folk tales, to take one example, characters frequently respond to conflict by engaging in clever deception. "The underdog wins by outsmarting his opponent" is a common conflict theme. Further study of stories from different cultures and subcultures may reveal other distinct patterns. This might indicate the need to diversify the diet of stories given to children.

Conclusion

Our studies of children's stories are highlighting features which may account for reader involvement with characters for reader enjoyment, and for difficulty in comprehension. We have been led to consider features which have traditionally been viewed as topics within the domain of literary analysis and criticism rather than that of reading research. Thus, although these features have direct implications for reading, our examination has taken us far afield from some traditional categories of reading research, such as word and sentence difficulty. We believe it is useful to continue this exploration.

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Mapping: Representing Text Structure Diagrammatically

Bonnie B. Armbruster and Thomas H. Anderson

An ongoing project at the Center for the Study of Reading is the development of an new method for quantifying the comprehensibility of expository text. The method uses a technique called mapping, which is a way of visually representing the important relationships that define the structure or organization of expository text. Mapping uses seven basic relationships: (1) EXAMPLE, (2) PROPERTY (with DEFINITION as a special case), (3) COMPARE/CONTRAST (including similarity, dissimilarity, greater than, less than), (4) TEMPORAL, (5) CAUSAL, (6) ENABLING, and (7) CONDITIONAL ("If A then B"). Mapping also recognizes negation and the logical connectives and or, and but. See Figure 2 for an example of a passage and the corresponding map.

Mapping was developed as part of an instructional package on studying skills. In developing the package, we discovered that the poorly written, difficult-to-understand expository materials that we were finding in children's textbooks were also difficult to map. This perceived relationship between comprehensibility and "mapability" led us to believe that we might be able to use an index of mapping behavior as a measure of text comprehensibility.

Ice Age

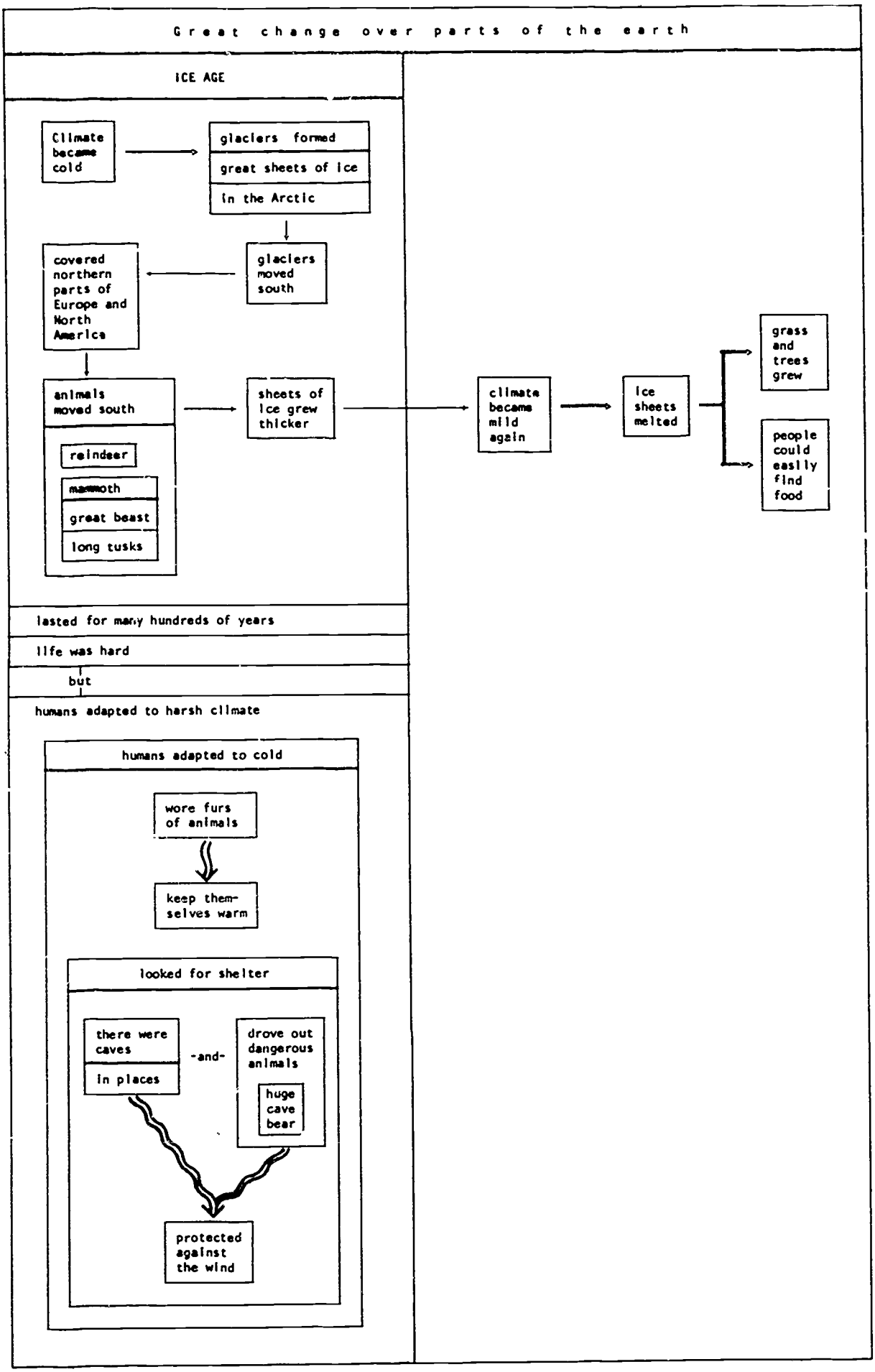
As time passed, a great change came over parts of the earth. The climate became very cold. Cold temperatures caused glaciers, or great sheets of ice, to form. The glaciers moved from the Arctic regions southward until they covered northern parts of Europe and North America.

This period of time when the glaciers were moving southward is now known as the Ice Age. Such animals as the reindeer and the mammoth moved far south. The mammoth was a great beast with long, curved tusks.

The Ice Age lasted for many hundreds of years. Life was hard, but humans were able to change their ways or adapt themselves to the harsh climate.

As the sheets of ice grew thicker and covered more and more land, humans had to adapt themselves to the cold. They wore the furs of animals to keep themselves warm. And they looked for shelter to protect themselves against biting winds. In many places there were caves. Sometimes, before humans could live in a cave, they had to drive out dangerous animals like the huge cave bear. In time the climate became mild again, and the ice sheets melted. Grass and trees grew again. People increased in numbers because they could easily find food.

Figure 2a. Sample passage from The Old World (Lefferts & Soifer, 1978).


Great change over parts of the earth
ICE AGE
Climate became cold
glaciers formed
great sheets of ice
in the Arctic
glaciers moved south
covered northern parts of Europe and North America
animals moved south
reindeer
mammoth
great beast
long tusks
sheets of ice grew thicker
climate became mild again
ice sheets melted
grass and trees grew
people could easily find food
lasted for many hundreds of years
life was hard
but
humans adapted to harsh climate
humans adapted to cold
wore furs of animals
keep themselves warm
looked for shelter
there were caves
in places
-and-
drove out dangerous animals
huge cave bear
protected against the wind

In working toward our index of comprehensibility, we borrowed some ideas from a discipline related to reading, rhetoric. Rhetoricians, of course, approach the issue from the perspective of the writer: What can the author do to improve the comprehensibility or clarity of prose? According to the rhetoricians, well-written paragraphs have at least these characteristics: unity, order, and coherence.

The first component, unity, refers to the extent to which the text discusses one main topic only. A unified text is one in which every idea seems to contribute to an answer to the author's question or purpose; nothing seems out of place or irrelevant.

The second component, order, refers to the structure or pattern of organization of the prose. Several structures appear to be fundamental; that is, they are common vehicles for thought. One of the factors influencing the comprehensibility of text is how consistent the structure is with the author's purpose; another feature is how apparent that structure is to the reader.

The third component is coherence. Coherence is the extent to which the ideas are woven together. In a coherent text, the relationship among ideas in text must be clear enough so there is a "flow of meaning" from one idea to the next. Coherence makes it easy for the reader to see the text as an integrated unit.

In summary, the comprehensibility of text reflects the extent to which the author has managed to achieve unity, order, and coherence in his writing.

The challenge that we accepted was to devise some method of quantifying or indexing unity, order, and coherence. Then we wanted to conduct research to demonstrate that when these characteristics are violated, the reader's comprehension suffers.

Our work has led us to believe that mapping may be a way of capturing all three constructs at once. We think that the process of mapping can serve as an index of comprehensibility.

We are currently using the following procedure:

1. Parse the text to be analyzed into idea units. Type one idea unit per card on 3" x 5" index cards.

2. Number the cards in the order that the idea units appear in the text.

3. Read the first card and place it face up on a table in a "pending file."

4. Read the next card and determine how it is related to the first card. Indicate the relationship by juxtaposing the two cards and placing a third card between them which shows the type of relationship

(e.g., temporal, causal, etc.). Repeat for subsequent cards. Any card which cannot be related to previous cards is placed in a pending file. This card can then be the beginning of a new map.

5. Make a record of each step (e.g., 4 --> 5 means "Idea Unit 4 causes Idea Unit 5").

6. Record the certainty of the relationship. A 1 means the author made it blatantly clear by using a "clue word;" a 0 means that it must be inferred.

7. After all idea units have been mapped by interrelating them as well as possible the first time through, record the number of steps required.

8. Note the number of individual "island" maps that were started from cards placed initially in pending files.

9. Make necessary inferences in order to integrate all maps into one.

We intend to experiment with the following measures to predict comprehensibility:

1. Total number of steps required to produce "best" map.

2. Proportion of total number of steps to produce "best" map to the number of steps required for the first time through.

3. Number of separate "island" maps after one pass through.

4. Proportion of very clear relationships (those that were rated 1) to total number of relationships.

Unity and order should be reflected in ease of producing an integrated "best" map of the text. Coherence should be reflected in the clarity of the relationships among individual idea units.

Assuming that we are successful in indexing unity, order, and coherence, and assuming that we are able to show that one or more of these constructs do affect comprehension, what then? We would hope that our method could be put to practical use. Obviously, as presently construed, it is rather cumbersome--not nearly as simple as a readability formula. However, we hope that it might be used in several ways. First, and most importantly, in the preparation of instructional materials, or texts. Our research may be able to suggest some practical guidelines for textbook writers. Or at least, an analysis of some sample text in preparation may point out strengths and weaknesses to guide revision efforts. Second, our technique may help school

districts make the all-important decision about which textbooks to adopt. Again, an analysis of sample text from candidate textbooks might yield a relative ranking in terms of comprehensibility of the prose.

An Educational Technique to Encourage Practice with High-Level Aspects of Texts

Andee Rubin and Dedre Gentner

This paper describes a set of classroom devices called the Story Maker. At first glance they appear to be directed solely toward the teaching of writing. Yet they grew out of a concern for teaching reading comprehension and our growing realization that both reading and writing are best taught when they are regarded as inseparable -- as the two necessary components of written communication. As we explored the devices we will describe here it became clear that it is possible to design methods which serve to re-unite reading and writing in the classroom, where they have been to a large extent artificially separated. Children using the Story Maker are actually creating stories which are clearly meant to be read and discussed by classmates -- and are therefore practicing writing -- but they are simultaneously reading stories which someone else has written and therefore are having to contend with unfamiliar words, events, and plot structures.

The original motivation for the development of these devices was our desire to translate some fundamental perspectives on text into classroom tools. Our approach then tries in several ways to provide a context in which children see and experience reading

and writing as two closely-related facets of communication, rather than as subjects relegated to nonoverlapping time periods in school.

We have used the phrase "conceptual readability" to designate an approach to textual analysis which focuses on high-level text characteristics such as the role of examples in an explanation, the communication of characters' plans in a story, and the global structure of arguments. The emphasis on the word conceptual contrasts this view of text with the more traditional focus of readability formulas on syllables per word and words per sentence. This perspective suggests some clear directions for research on reading and writing, leading us to develop formalisms for describing different text structures and to investigate the impact of their characteristics on comprehensibility. However, the implications of such an attitude toward text for classroom teaching are less clear. Given a belief that high-level characteristics of text are central to readability and that an awareness of them is a crucial component of comprehension, how do we help children in classroom settings focus on these aspects of the texts they read and write? What kinds of classroom situations can we create which draw children's attention away from individual words or sentences to an appreciation of the organization of expository text or the working through of a confrontation in a story?

This paper will describe, first, the general educational guidelines which derive from our framework, and then, a group of related classroom devices which embody the "conceptual readability" perspective in practical tools. We see these more general goals as important for any educational method designed to encourage children to focus on high-level aspects of text in both reading and writing.

Educational Goals

Our emphasis on high-level aspects of text leads us to adopt a set of specific educational choices which help direct children's attention toward these crucial text characteristics.

1. Provide an active language experience which allows children to construct stories easily. The key word in this sentence is "active"; most reading experiences require little overt action from students other than to answer comprehension questions at the end of the selection. The combination of reading and writing in a single experience allows children to be involved in and captured by the activity and to have in the end a story they have produced in a much shorter time than it would usually take them to write one.

2. Demonstrate to children the consequences of choosing different ways for a story to proceed. Reading has been described as a process of formulating and evaluating hypotheses (Smith, 1973); in recent work, writing has been seen as involving a series of choices which satisfy constraints imposed by the task (Collins & Gentner, 1979). In both cases, decisions made early in the process significantly limit available options later. An educational method should demonstrate this interdependence to children, rather than simply stating it in words.

3. Avoid the pitfall of overemphasis on low-level characteristics of text such as spelling and handwriting. Several researchers have pointed out the complex cognitive processes involved in reading (Perfetti, Note 3) and writing (Flower & Hayes, in press; Wason, 1979; Scardamalia, Bereiter, & McDonald, Note 4). Collins and Gentner (1979) have noted children's tendency to "downslide" into concentrating on lower-level processes such as decoding (in reading) or spelling and handwriting (in writing) when the task becomes too complex (see also Luria, 1929). Our goal is to construct an

educational method which frees children's attention from these details so they can concentrate on higher-level aspects of the text.

4. Provide a real audience for children's compositions. New research and teaching techniques in writing emphasize the importance of children's awareness of the audience to whom they are writing and the use of a real audience to provide feedback to young writers (Bruce, Collins, Rubin, & Gentner, 1978; Scardamalia, in press; Van Nostrand, Knoblauch, McGuire, & Pettigrew, 1977). Yet most of the compositions children produce are written to elicit good grades and comments from the teacher, rather than to communicate. Techniques are needed which naturally provide an audience for children in school.

5. Create a natural context for comparing and discussing stories with different high-level characteristics. Comparing and contrasting objects which share some but not all attributes is a central strategy for learning; this point has been made by researchers investigating cognitive processes in general (Gentner, 1977; Moore &

Newell, 1973) and incorporated into language arts curricula (e.g. Moffett, 1976). While children can always be asked specifically to discuss the similarities and differences among several stories, our goal is to create an activity where the motivation for the comparisons grows out of the task itself.

6. Provide a social and cognitive context in which it is natural for children to work together on language activities. Recent studies by anthropologists and ethnomethodologists have pinpointed the importance of social organization and interaction in classrooms (McDermott, 1978; Cole, Hood, & McDermott, Note 5). Children writing in school, however, often work in isolation, rarely interacting even with the teacher (Rubin, 1980). School situations must be modified to encourage students to interact productively in the context of reading and writing activities.

7. Provide a motivating, nonthreatening, success-oriented context for language activities. While this goal is hardly innovative or unique, it is certainly more difficult to achieve these

THE HAUNTED HOUSE

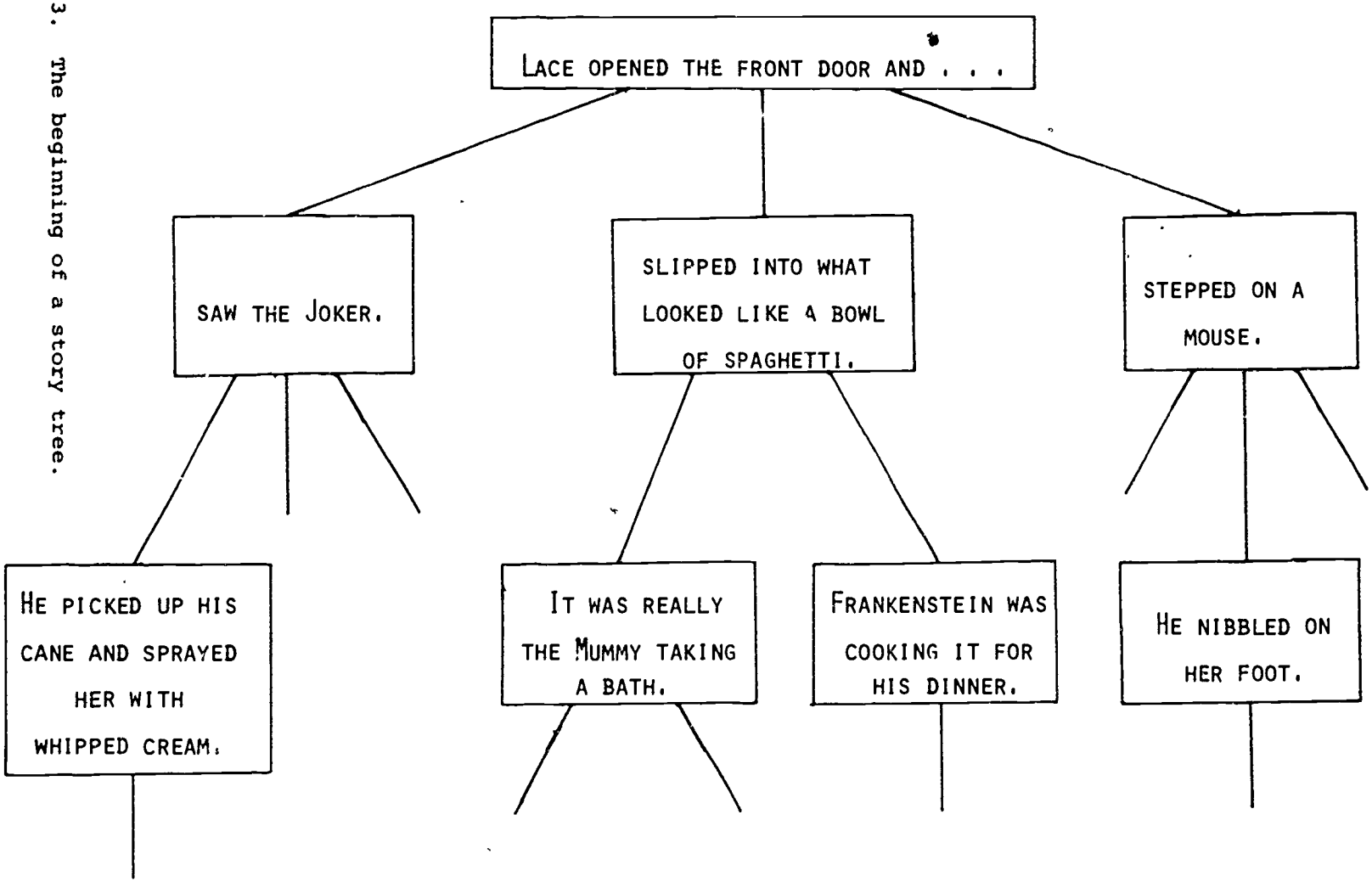


Figure 3. The beginning of a story tree.

aspects of educational activities than to describe them. Attention to motivational aspects of classroom activities is crucial to their success.

The devices we have developed attempt to address all of the above goals. Although there are a large number of language activities which derive from these tools (see Rubin, 1980, for more details), we will focus on only two of the basic ones here and explain how they relate to the general points we have listed.

The Story Maker

The most basic device we will describe is called a Story Maker. It is essentially a tool which allows children to create stories by choosing options from a set of already-written story segments. After making a series of choices, a child has a completed story which he or she can read, copy, illustrate, and show to parents and friends. These choices are structured as a tree--that is, initial choices a child makes constrain choices he or she can make later in the process.

The beginning of a story tree in Figure 3 illustrates the basic structure of a Story Maker activity. The tree is made up of a group of stories about a Haunted House; each story segment is contained in a box. Each story begins with "Lace opened the front door and . . ." and one possible story a child might

construct within this story tree would start out

> Lace opened the front door and slipped into what looked like a bowl of spaghetti. Frankenstein was cooking it for his dinner.

In the most elementary process of constructing a story from the tree, a child is actively involved in a reading and writing experience which quickly yields a complete story; thus this activity fulfills Goal 1, that of providing an active experience.

We have implemented the Story Maker so that a child cannot see a given set of alternatives until the time has come to choose among them. Thus, a child is sometimes surprised at the consequences of his or her choice. A child choosing among the first three choices in this tree, for example, would have no idea what story segments followed along any of the branches. Thus, choosing a path through a story tree gives children some awareness of the consequences of their choices. On initial experiences with a given tree, they're often surprised; when they know the tree better, they can make more informed choices. We can encourage children to focus more explicitly on the interdependence of their choices by superimposing story characteristic goals on their process of putting together a story. For example, we have asked children to try to write funny, confusing, or boring stories--or stories in which the

conflict between two characters remains unresolved. In the story tree in Figure 3, we have labeled the top-level branches of the tree as leading to funny stories, scary stories or stories involving television characters. Even in this simple tree, a child can make choices according to a goal which refers to global story characteristics; the technique thus addresses the second general goal of demonstrating the interrelatedness of story segments.

The Story Maker prevents both children and teachers from focusing attention on syntax, spelling or the like by guaranteeing that every story a child produces will be acceptable along these dimensions. Thus, the third goal is realized: Downsliding is virtually eliminated. Because it requires simultaneous concentration on fewer levels of the text, a child's task using the Story Maker is simpler than the job of writing a story from scratch. This was brought out in a recent pilot experiment. A 7-year-old girl created a "scary" Haunted House story using the Story Maker and then copied it. While she was transcribing the story, her attention was almost constantly drawn to the problem she has differentiating "b's" and "d's," but since the story itself was already determined, she could focus on her handwriting problem without sacrificing story content.

The Story Maker Maker

To illustrate a way of fulfilling the other four goals in our list, we will introduce an extension of the Story Maker idea -- a device called the Story Maker Maker. After children have had some experience with the basic Story Maker, they can construct their own Story Makers, deciding on the individual story parts and, perhaps, even the tree structure. Children working in groups can write story segments on index cards and then place them on hooks on a pegboard; branches can be indicated by pieces of yarn connecting the hooks. Multiple branches allow different children to see their own ideas of how the story should proceed included in the final product.

When the Story Maker is completed, another group of children can use it in the activities we have described above. This interaction achieves our fourth goal of providing a real audience for children's compositions. The Haunted House story tree partially shown in Figure 3, in fact, was written by a third grader with the help of an adult tutor. The author, Michelle, knew that her best friend Lace would later be using the Story Maker and so included her as the main character of the stories. The audience in such a situation may be quite expressive. Because their "reading" of the Story Maker requires active participation, a group of children provides considerable feedback to a Story Maker author.

When the children in Michelle and Lace's class used the Haunted House Story Maker to produce their own stories, the activity provided a means of addressing the fifth goal--the creation of a context for comparing stories with different high-level characteristics. Because they were all constructed from the same story tree, the stories were similar enough to invite comparison. Because each reflected an individual child's choices, they were different enough to force a contrast. The conversation around the classroom consisted mainly of comments such as, "Hey--mine has Lace and Frankenstein going to McDonald's too, but they don't get as much to eat!"

Goal 6, that of collaboration on a particular story, is facilitated by the actual physical layout of the Story Maker and Story Maker Maker. The size of the pegboard Story Maker Maker we have built (4 feet by 7 feet) almost necessitates participation by more than one child at a time. Thus, a group writing experience develops in which children trade off as main author or designer. Children constructing a Story Maker together often enrich each other's ideas, suggesting new directions when the process bogs down. Thus, these activities provide natural ways for children to collaborate on group writing projects.

Finally, Story Maker activities appear in our experience so

far to be highly motivating, satisfying Goal 7. Because every story produced using a Story Maker is correct in terms of spelling and syntax, a child is guaranteed at least partial success in this language activity. Children have shown marked persistence in working with the Story Maker. One 7 year-old girl worked with the Haunted House Story Maker after school, writing and copying three different stories, then went home and wrote another story and song, and finally compiled them all into a Haunted House book.

Summary

Story Maker activities, therefore, are one way to fulfill the seven goals we have identified as central for guiding children towards high-level communicative aspects of writing and reading. Although these devices are still in the experimental stages of development, our initial experiences with them have been sufficiently positive that we believe they are worth pursuing. These tools--and others that concentrate on the educational issues raised by our seven goals--have the potential to positively affect classroom language experiences.

Discussion

Ernest Goetz

The successful scout in the National Football League (NFL) must be vitally aware of the height, weight, and speed of each prospective draftee. The relationship of these parameters to success in the NFL is well demonstrated and established: The number of offensive linemen under six feet tall and 220 pounds is approximately equal to the number of defensive backs who require more than 4.6 seconds to run 40 yards. Both numbers are vanishingly small. But though the contribution of these obvious physical dimensions to success in the NFL is beyond dispute, no NFL team could survive if its prediction equation for draftee evaluation did not go beyond the obvious. Higher-level constructs such as "coachability," "hustle," and "willingness to play with pain" are crucial to the evaluation process.

The theme of this report is that the prediction of the ease or difficulty with which a reader will comprehend a text presents a similar situation: While physical attributes of a text, such as word length and sentence length, may contribute to a text's difficulty, one must look beyond the obvious surface characteristics for optimal prediction. Further, it is argued that an understanding of the real causes of comprehension difficulties which might lead to the improvement of texts or

readers will require the development of hypothetical constructs which go beyond the surface characteristics of text. The term conceptual readability refers to these emerging hypothetical constructs. Although NFL football is "just a game," and reading is a major concern of most parents and teachers, it is probably safe to project that "coachability" and "hustle" are better understood than conceptual readability. This report describes several efforts to close this conceptual gap.

In order to discuss the preceding sections, I would like to place conceptual readability in the larger context of the determinants of comprehensibility. The difficulty or ease with which a reader will comprehend a text depends at least upon: (a) the underlying conceptual difficulty of the topic or content of the text, (b) how clearly the content is expressed, and (c) the extent to which the reader has the requisite knowledge o the world, knowledge of the language, and knowledge of the comprehension process itself. While this list of determinants is neither mutually exclusive nor cumulatively exhaustive, and there are certainly important interactions between these factors, this framework for analysis may still serve to highlight a few key points relevant to the discussion.

The underlying difficulty of text content will vary as a function of the subject discussed in the text. Clearly, a

biology text which describes the human central nervous system is dealing with a more complex subject than a text describing the central nervous system of a goldfish or flatworm. the analysis of conflicts by Steinberg and Bruce suggests that the conflicts described in children's stories differ in their underlying conceptual difficulty. Their analysis may lead to a method for systematizing the measurement of this difficulty. The use of mapping to index the comprehensibility of expository texts, as outlined by Armbruster and Anderson, may also tap content difficulty. A well written description of a nuclear reactor will not only be more difficult to understand than an equally well written description of a teeter-totter, it will also be more difficult to map.

The clarity and comprehensibility of expression of a text includes those aspects of vocabulary and syntax tapped by conventional readability formulas, but goes far beyond them. The explicitness and clarity of expression of underlying content, and especially of the relationships between concepts, is a major concern of Armbruster and Anderson. Their use of mapping as a study strategy demonstrates how it can force the reader to focus on relationships between concepts, and provides a system for symbolically representing those relationships. It is hoped that familiarity with and utilization of a small set of relationships will facilitate comprehension and memory across a broad range of

texts. similarly, the conflict analysis of Steinberg and Bruce may reveal a relatively small number of conflict patterns that recur across a wide array of stories. The Story Maker of Gentner and Rubin is designed to teach the reader/writer about the consequences of events in stories, as well as the types of story elements that contribute to humor or suspense, and to encourage the reader/writer to employ this knowledge. Indeed, the Story Maker might well be used to illustrate and teach different conflict patterns, with different levels of the tree corresponding to the type of conflict, response mode, and resolution.

The efforts reported here are potentially capable of making significant contributions at all three levels of analysis. Hopefully, the results will be used in applications where readability formulas are the only current options. If, as Kantor and Davison claim, adaptors are sometimes too greatly concerned with factors which produce favorable readability scores, at the cost of comprehensibility, it is probably because readability formulas are available, objective, economical, and established. What is needed are equally accessible and effective methods for assessing conceptual readability. If, as Gentner and Rubin argue, writing instruction has often focused on such low-level concerns as syntax and spelling, it is probably because the rule systems and instructional techniques are relatively well worked

out and well known. What is needed is a comparable understanding of and instructional techniques based on conceptual readability.

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